Mechanics' & Farmers'

MAGAZINE

OF USEFUL KNOWLEDGE.

"GET WISDOM: AND WITH ALL THY GETTING, GET UNDERSTANDING."

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I stated, in my first number, that the continuation of this work would depend upon the contingency of public patronage. I am now happy to have it in my power to say, that the encouragement I have received, has been greater, than, with a full knowledge of the disastrous fate of many similar, and perhaps more meritorious publications that have preceded it, I could reasonably have expected. From a portion of the citizens of New-York, and its vicinity, I have met with a cordial welcome, and the most friendly wishes for my success. These kind expressions are duly appreciated, and it shall be my earnest endeavor to merit the confidence of those who have thus early accorded it to me.

I did not embark in the undertaking in which I am engaged, lightly estimating the difficulties attending it; but I firmly resolved to "do all that may become a man" to surmount them, and leave the rest to fate. I was fully aware of the numerous publications that have been commenced in this city, and failed for want of sufficient encouragement; nor was I ignorant of the charge so often reiterated against the citizens of the "Commercial Emporium," of withholding their support from every thing of a useful and scientific nature. Notwithstanding these charges, however, I was unwilling to believe, that a work, whose sole object should be to combine *instruction* and *amusement*, to afford its readers *gratification*, as well as *improvement*, would not receive, from a liberal and en-

lightened community, a support proportioned to the ability with which it should be conducted; nor have I, as yet, had any reason to change my opinion.

Believing that my exertions would not go unrewarded, I have spared no pains or expense in endeavoring to render the Magazine not only *useful* and *interesting*, but worthy of that support to which I look, with confidence, from the inhabitants of this city, as well as the community at large. Having associated with me in the editorial department, a gentleman well known as a man of great literary and scientific attainments, and having also made arrangements with several gentlemen of talent, both in city and country, to become contributors to the work, I cannot doubt, it will both deserve and receive a liberal support. In justice to myself and the gentleman associated with me, I ought to remark, however, that, owing to causes which it is not necessary to enumerate, and which those only who have been engaged in *establishing* a periodical publication, can fully understand, the first and present numbers neither contain the amount of original matter, nor that methodical arrangement which we expect to be able to give to the future numbers.

In making the arrangement above mentioned, I have been induced to change my original intention, with regard to the frequency of publication; it is thought that the work can be made more acceptable to the public by publishing it *monthly*, instead of semi-monthly. The same number of pages, however, will be given, as first promised. Another alteration will also be made, after the present number. The present title of the work conveys an idea, that it is intended *exclusively* for Mechanics and Farmers; such is not the fact; it is intended for *all classes*, but more *particularly* for those who have not had the advantages of a scientific education. I shall, therefore, adopt the more general title of "THE MAGAZINE OF USEFUL AND ENTERTAINING KNOWLEDGE," under which it will hereafter be issued *monthly*.

N. SARGENT.

NATURAL PHILOSOPHY.

(*Continued from page* 17.)

In consequence of the diminution of the temperature of the atmosphere as we ascend from the earth, it is evident that there must be some point where water cannot long remain in a state of fluidity; or in other words, a point of perpetual congelation; such is found to be the fact. The altitude of this point varies, however, in different latitudes, and in some degree in the same latitudes, depending on the temperature of the region below. At the equator this point was ascertained by M. Bauger to be at the height of about 15,500 feet above the level of the sea; whereas Saussure found it to be at the height of 13,428 feet on the Alps. The altitude of course decreases as we depart from the equator. Thus we have given the simple reason why the tops of the highest mountains are clothed in the mantle of perpetual snow; a fact well known by all, but extremely puzzling to those who, never having examined the subject, have erroneously supposed that the nearer they approached the sun, the greater, of course, must be the heat.

The air was formerly considered as a simple elementary fluid, nor was the contrary discovered till a little more than half a century ago. Several Philosophers have claimed the honor of having made the discovery that it was a compound substance, among whom were Dr's. Black, and Priestly, and Mr. Cavendish, each of whom made some advances towards it; but we believe Scheele and Lavoisier were the first to place the subject in its proper light. According to the experiments of Mr. Cavendish, confirmed by those of Sir Humphrey Davy and others, atmospheric air is composed of 21 parts by bulk of oxygen, and 79 parts of nitrogen, very nearly; it always, however, holds a greater or less portion of water in the form of vapour: the amount of vapour thus absorbed by the atmosphere is immense:—from an experiment of Dr. Halley, made to ascertain the evaporation from the surface of water heated to the same degree with that given by the sun at noon-day, he estimated the evaporation of the Mediterranean sea, during one summer's day, at 5280 millions of tuns (252 gallons each.) Dr. Watson also made some experiments with the view of ascertaining what quantity of water evaporated from the earth during a time of drought, which he found to be not less than 1600 gallons from one acre of ground in twenty-four hours.

Though the atmosphere is a kind of general repository of all the noxious effluvia arising from the decomposition of animal and vegetable matter, the amount of which would seem to be sufficient to render it unfit for human respiration and destructive of animal life, yet nature has wisely provided means by which it is purified, and rendered wholesome: this is done partly by the water which it absorbs, (a great purifier of air,) and partly by the vegetable kingdom; for this purpose it is admirably contrived that plants shall derive subsistence from, and absorb that very air, or effluvia which is so noxious to animals, and emit that which is essential to animal existence, namely, oxygen; thus we perceive the mutual dependence of the animal and vegetable kingdoms upon, and the reciprocal aid they render each other.

We have before stated the weight of the atmosphere to be equal to 14 or 14½ pounds upon the square inch at the surface of the earth. If we suppose that a man's body exposes a surface of 15 square feet, he will consequently sustain a pressure of nearly 15 tons: this enormous weight would be insupportable were it not for the fact, that by insinuating itself into every part of our bodies it counterbalances itself; but if this pressure were suddenly removed, our blood vessels would burst and life be immediately extinguished.

From the circumstances of the atmospheric pressure being counterbalanced in this manner, we are unconscious of the weight we sustain; but let a person place his hand upon a common sized tumbler, in which he has just placed a piece of burning paper, or other substance, so tight that no air can get in, and he will immediately perceive the weight of the atmosphere by its producing a sensation as if his hand were sucked down by the glass; in this case the air within the tumbler being exhausted by combustion, a vacuum is produced, and consequently the pressure removed from the *under* side of the hand, while that upon the upper side remains and presses it down with a force equal to about 100 pounds.

Without this pressure of the atmosphere, as we are at present constituted, the earth would be uninhabitable by man; it is that which prevents fluids from evaporating, and preserves water in its aqueous form, without which it would pass off in vapour at a temperature much below that of the human body. We have shown that without that density which weight alone gives to the air, we are unable to inhale a sufficient portion of it to support life, and it is this density also that enables the feathered tribes to soar aloft, and navigate their proper element.

Of the Phenomena and Causes of Hail Storms. By Denison Olmsted, Professor of Mathematics and Natural Philosophy in Yale College.

Showers of hail present themselves to us under two very different forms. Sometimes they consist merely of frozen drops of rain, unaccompained by any extraordinary appearances; and are easily accounted for, by supposing that, the air happens, at that time, to be colder than the region of the clouds, and that the drops of rain are congealed in falling through it. But in those *storms* whose mysterious causes we are now desirous of penetrating, the hail stones are of great and sometimes enormous size, and are associated with the most impressive and sublime phenomena of nature.

To pass over many statements on record of hail stones of a magnitude almost surpassing belief,* we have authentic statements of such as exceeded one foot in circumference,† and those larger than a hen's egg are of yearly occurrence.

To account for these extraordinary hail storms, is considered as one of the most difficult problems in meteorology. There is little to be found on this subject in systematic works; but the accounts of the facts lie scattered up and down in scientific journals, and in the transactions of learned societies. After comparing a great number of these descriptions of hail storms, the following propositions appear to me to embrace the most important facts:

1. *Hail storms, when violent, are characterised by the meeting of all the elements of storms;* the clouds are very black; they are strongly agitated, and fly swiftly through the air, or more frequently rush towards each other, attended by high winds and terrific thunder and lightning.‡

2. *Hail storms, of the foregoing character, are confined chiefly to the temperate zones.* They rarely occur in any torrid zone;‖ and when they do, it is chiefly on high mountains. Hail is indeed frequent in the polar regions; but it is of the ordinary kind before

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* It is related, that, during the wars of Lewis the XII, in Italy, in 1510, there was, for some time, a horrible darkness, thicker than that of night: after which the clouds broke into thunder and lightning, and there fell hail stones of one hundred pounds weight. (Encyc. Perth ii, p. 14)

†Halley, Phil. Trans.

‡Phil. Trans. vols. iv. and v.

‖ Rees says never; but the Ed. Encyc Art. Phys. Geog. says, "at an elevation not less than 1500 or 2000 feet." V. Tilloch's Mag. vol. xliii, p. 191.

mentioned, and is, therefore, not the subject of the present inquiry. Of all places in the world, the south of France is most remarkable for frequent and violent hail storms. During the year 1829, an insurance company was formed in France for the special purpose of affording protection against their ravages.

3. *The most violent hail storms occur chiefly during the warmer half of the year, and most frequently in the hottest months.*

4. *The hail stones that fall during the same storm, are found to be much smaller on the tops of mountains than in the neighboring plains.*

5. Though hail stones are of various forms, yet *they frequently exhibit in the centre a nucleus, which is white and porous,* while the other parts consist of concentric layers of ice, either transparent or of an opake white, or alternately transparent and opake.

6. *A shower of hail, during the warm season of the year, is often followed by cooler weather;* in spring and fall, particularly, hail is a well known precursor of cold.

Whatever may be the remoter cause of this phenomenon, we can be at no loss for the immediate cause, namely, *a sudden and extraordinary cold in the region of the clouds, where the hail stones begin to form:* Nor can there be any doubt, that the degree of cold by which the nucleus is congealed, must be very intense,—far below 32°, or the freezing point of water—since this nucleus, as there is every reason to believe, rolls up to the final size of the hail stone, by congealing upon itself the watery vapour which it meets with in its descent to the earth. But, although the presence of such an intense degree of cold is implied in the formation of hail, yet the great question before us, is, *what is the origin of this cold itself?* Among the different suppositions which have been made, or which may be made, there are only two worthy of notice. One is, *that the cold is generated by the immediate agency of electricity;* the other, *that it is derived from the region of perpetual congelation.*

In the first place, *what reason have we to believe, that the cold which produces hail is generated by the agency of* ELECTRICITY? Were we to confine our attention to the whimsical reasons, or to the gratuitous assumptions, on which most writers upon electricity proceed, in ascribing to it the power of producing such an extraordinary degree of cold, we should conclude, at once, that the

hypothesis was without foundation.* But it is still proper to inquire if we cannot discover a connexion between some known property of electricity, and the sudden production of an intense degree of cold. It is a known property of electricity *to rarefy air*, and rarefaction produces cold. When we strongly electrify a Leyden jar, the air is frequently so much rarefied as to rush out from an opening in the cover with a hissing noise. In like manner, the air, which supports and envelops thunder clouds, being strongly electrical, might be conceived to be powerfully rarefied, and the temperature proportionally reduced. The power of a sudden rarefaction of the air to precipitate in the form of hail, the moisture contained in it, is strikingly exemplified in the apparatus employed for raising water at the mines of Chemnitz, in Hungary. The only point to be attended to, at present, is, that a quantity of air, previously confined under the pressure of a column of water 136 feet in height, is suddenly permitted to escape, and has its temperature so much reduced by the enlargement of the volume, that the moisture present falls in a shower of hail.†

Another argument in favor of the supposition, that hail owes its origin to electricity, is derived from the protection against hail-storms alleged to be afforded to vineyards in France, and the neighboring countries, by erecting among them long pointed poles, or *hail rods*, (paragreles) as they are called. Could the fact be fairly established, that places furnished with such hail rods are protected from the ravages of hail storms, while other places in the midst of them, and all around them, are laid waste by these destructive visitations, it would go very far to prove that hail is produced by the agency of electricity. This point, therefore, requires to be considered with attention.

It is now more than 50 years since it was first proposed by men of science, in France, to avert the calamities which that kingdom sustains, in a very peculiar degree, from hail-storms, by erecting conductors with the view of drawing off the electricity that was supposed to generate the storms. The land proprietors, however,

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* See, especially, Priestly's History of Electricity, p. 371; Malte Brun, Phys. geog. vol. 1.—Van Mons, in Nicholson's Phil. Jour. xxiv. 106.

† Lib. Useful Knowl. Art. "Hydraulics, p. 18. The same views with respect to the origin of the cold of hail storms are expressed in this Journal, vol. xv. Morveau, also, has the same idea. (Journal de Phys. ix. 64.) Idem. xxi. 146.

did not display the expected eagerness to avail themselves of the proposed security, and a writer complains, that for thirty years afterwards, not a single landholder had put the experiment in practice.* But as late as the year 1821, the Linnæn Society of Paris† revived the interest‡ in this subject, and caused numerous experiments to be made, which have inspired, it appears, much confidence in the efficacy of hail rods. In a late number of the Annals of that Society, the subject is thus noticed: "The Paragrele, or hail rod, has, for several years, occasioned much inquiry on the continent, and has engaged the particular attention of the society. In many districts, which were formerly, year after year, devastated by hail, the instrument has been adopted with complete success, while in neighboring districts, not protected by paragreles, the crops have been damaged as usual; and the Society are receiving, from all quarters, statements which fully confirm their opinion of the utiltiy of the invention. The Society have made a report to the ministers of the interior, recommending that measures be adopted by the general government, for protecting the country from hail; and it is estimated, from the result of experiments in numerous districts, that if paragreles were established throughout the whole of France, it would occasion an annual saving to the revenue of fifty millions of francs."‡

The statements are certainly favorable to the hypothesis in question; but since the experiments are in their infancy—since hail storms are often of very limited extent, and, of places very near to each other, one is desolated, while another escapes uninjured—and since such apparent exceptions in favor of the utility of hail rods would be very naturally exaggerated, I do not feel warranted in assuming the fact of their efficacy as fairly established.§ With regard to the merits of the hypothesis in general, I would offer the following remarks:

1. Although we can conceive that a portion of the atmosphere, suddenly and highly rarefied by electricity, might produce the de-

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* Tilloch's Phil. Mag. vol. xxvi, p. 213.

† Am. Jour. vol. x. p. 196.

‡ Am. Jour. vol. vii, p. 298.

§ The establishment of Hail Insurance Companies, so late as the year 1829, indicates a want of confidence in this kind of protection. On account of the efficacy of lightning rods, no such companies are needed to secure the public, against damages by lightning.

gree of cold requisite to form hail, yet the *possibility* of an event is but slight evidence of its reality ; and we have here no independent evidence that such a rarefaction does in fact take place ; but, on the contrary, we have certain evidence, from the concourse of opposite winds, from the density and consequent blackness of the clouds, that a great condensation of air takes place in the region of the storm.

2. If hail be produced by electricity in the manner supposed, why is it not a *constant* associate of thunder storms, since the same causes operate continually ; yet the rare occurrence of hail storms, as well as their desolating effects, mark them, as out of the common course of nature. Why, especially, do not hail storms occur in the torrid zone, where the electricity of the atmosphere is most abundant, and the phenomena of thunder storms the most violent and terrible ? Not being able, therefore, to satisfy ourselves that hail storms are produced by the agency of electricity, let us inquire, in the second place, *what reason we have to believe that they owe their origin to the cold of the upper regions of the atmosphere.*

It is a well known fact, that the atmosphere grows continually colder as we recede from the earth, until, at a certain elevation, we reach the temperature of freezing water, called the *term of congelation ;* that the height of the term of congelation, above the surface of the earth, varies with the latitude, being greatest at the equator, but coming very near to the earth at the pole; that its average height, at the equator, is about fifteen thousand feet, at the latitude of 30° twelve thousand feet, and at the latitude of 50° six thousand ;* that beyond this line of perpetual congelation, the reduction of temperature still proceeds, until it shortly reaches a degree of cold the most intense that can be imagined. If we now contemplate a current of air, that is, a wind blowing horizontally, first at the surface of the earth, and afterwards at different elevations, we shall find that it will be subject to the following modifications. We will suppose it to blow first from the polar towards the equatorial regions. When it moves at the surfaee of the earth, it will rapidly imbibe the heat of the earth as it traverses the warmer latitudes ;

* Ed. Encyc. " Phys. Geography."

at the height of one thousand feet it will feel the influence of the earth much less, and grow warm much slower than before; and at the height of ten thousand feet, it will, for the most part, sweep quite clear of the mountains, and be a current of air blowing through the atmosphere alone. And since, as in the case of the gulf stream, a fluid does not readily change its temperature, merely by flowing through air, a wind blowing from north to south, at an elevation of ten thousand feet above the earth, will pass to a great distance without materially altering its temperature. What we have here supposed, respecting the heating of a northerly wind, as it blows southerly, will obviously apply to the cooling of a southerly wind, as it blows northerly; and since a high wind frequently moves at the rate of sixty miles, or about one degree an hour, especially where it passes without obstruction in the upper regions of the atmosphere, it would consequently pass over ten degrees in the short space of ten hours.*

These things being clearly understood, we assign, as the cause of hail storms, *the congelation of the watery vapor of a body of warm and humid air, by its suddenly mixing with an exceedingly cold wind, in the higher regions of the atmosphere.* Let us examine the effects which would result from the meeting of two opposite winds, at the height of ten thousand feet, during the heat of summer, the one blowing from the latitude of 30° or from the confines of the torrid zone, and the other from the latitude of 50° or the northern part of British America. If they had equal velocities, they would meet at the parallel of 40°, that is, at our own latitude, in ten hours from the time of setting out; and according to what has been premised, each current would retain nearly the original temperature. The southerly wind blowing from a point which is still two thousand feet below the line of perpetual congelation, is comparatively warm, while the northerly wind coming from a point which is four thousand feet above the same boundary of the empire of frost, will have a degree of cold probably surpassing any with with which we are acquainted. We infer, from our preliminary principles, that immediately on meeting, the watery vapor of the warmer current would be frozen with an intensity corresponding to the temperature of the colder current: that the minute hail stones thus formed, and endued with such excessive cold, would begin to de-

* Daniel's Meteor. Ess. 113.

scend and accumulate to a size proportioned to the intensity of the cold of the original nucleus—to the space through which they descended—and to the humidity of the lower strata of the atmosphere; that is, the colder they were when they began to fall, the farther they fell, and the more humid the air, the larger they would become.

We have supposed a strong case, namely, that the wind from the torrid zone is suddenly brought into contact with a wind coming directly from a point far within the limits of perpetual frost, a concurrence of circumstances which appears to be not improbable, and which appears also sufficient to explain the most extraordinary phenomena of hail storms. But since natural causes do not commonly operate in their greatest possible energy, it is probable that hail storms usually result from these causes acting under circumstances less favorable in various degrees. We need not even suppose any thing more than that the cold current, instead of meeting with an opposite hot wind, merely mixes with the stationary air of the hotter climates in order to precipitate their moisture in the form of hail. In every minute description of a violent hail storm, however, we shall probably find mention made of this common circumstance that *opposite and violent winds met*,* hurrying on the clouds from opposite points of the compass. Thus a writer in the American Journal of Science, describing a violent storm that occurred in the state of New-Jersey, adds, "I observed, then, and have many times observed since, that hail is usually accompanied by contrary winds which seem striving over our heads for the mastery." And Beccaria recognises the same feature of clouds congregated from opposite quarters. "While," says he, "these clouds are agitated with the most rapid motions, the rain generally falls in greatest plenty, and if the agitation be exceedingly great, it generally hails."†

We will now see how far the foregoing explanation corresponds to the facts before enumerated.

Why then are violent hail storms attended by all the other elements of storms,---by clouds of intense blackness, and terrific thunder and lightning? Because the sudden concourse of a wind exceedingly cold, with one comparatively hot, ought, in conformity

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* Clark in Am. Jour. ii, 134. Beccaria on Elec. in Priestley, 341.

† Priestley, 841, Nich. Jour. xxiv, 111.

with the known causes of these phenomena, to exhibit them in their most energetic forms. All these atmospheric phenomena are linked together, and the same cause acting with different degrees of energy, produces each of them in its turn. The mixing of portions of air differing but little in temperature is sufficient to form clouds—if the temperature differs somewhat more, the watery vapor may fall in rain—if the one portion is hot and the other cold, more sudden and powerful rains are the consequence, and thunder and lightning result from the rapid condensation of watery vapor—and finally, when a powerful wind from the regions of perpetual frost, mixes with the heated and humid air of a warmer sky, the same watery vapor descends in hail.

Why are such violent hail storms confined to the temperate climates, and why do they occur neither in the torrid nor in the frigid zone? This is a point of great difficulty, and the question has never, to my knowledge, been satisfactorily answered; but I think we perceive something in the foregoing principles, which may lead us to a correct understanding of it. We have considered the case of two opposite winds from points differing twenty degrees in latitude, one blowing north from the 30th, and the other south from the 50th degree of north latitude, each being at an elevation of 10,000 feet above the earth; and we have found them sufficient to explain the occurrence of violent hail storms within the temperate zones, at least in our own latitude; other opposite points may be assumed for other latitudes. But suppose we transfer this reasoning to the equator, and consider the condition of two opposite winds blowing from ten degrees on either side, and meeting at the equator, each being at the same elevation of 10,000 feet above the earth. Now both of these winds would be warm, and almost equally so, and here of course, would be wanting that intensely cold current which we have been able readily to summon to our aid to help in forming our hailstone, in the temperate climate. If we take any other point within the torrid zone, the case would be indeed somewhat less unfavorable to the production of hail; the opposite currents might differ in temperature to a degree sufficient to account for the formation of clouds, and rain and thunder and lightning; but in this region we know not where to look for that *freezing current*, unless we ascend so high, that there, no hot air exists, holding watery vapor to be frozen by it. The case is plain, that if we ascend in the torrid zone for air that is cold enough to answer our purpose, we ascend above

the region of the hot air, the watery vapor of which is necessary to afford the materials for hail; whereas, in our own latitude, on ascending to the region of congelation, we find the north and south currents differing in temperature, more than opposite winds in any other part of the globe. There is indeed one situation where we may imagine hail to be formed within the torrid zone; and that is in the vicinity of lofty mountains covered with snow; and there in fact it does sometimes hail.*

Next, if we attentively consider the circumstances of the frigid zone, we shall see that here there is no hot region on the one side to send its heated air, to mix with the cold currents from the other; and that no meeting of very cold with warm winds could possibly take place. The rain, indeed, on account of the ordinary cold of this region, would frequently descend in the form of hail: but it would necessarily be of that small and ordinary kind, which is formed near the earth, before described as being common in the polar regions.

France is so peculiarly exposed to hail storms, on account of its situation between the Alps and the Pyrenees. The country lying between these high mountains being heated by the summer's sun, the cold blasts from the regions of snow and ice, mingling with the hot and humid air over the intervening country, ought, in conformity with our principles, to produce frequent hail storms.

The most violent hail storms occur in the warmer season of the year, and usually in the hottest month, because it is then that the heat of the sun contributes most to set the opposite currents in motion. Hail stones are smaller on the tops of mountains than in the neighboring plains, because not falling so far, they have less opportunity to accumulate by the congelation of successive layers of watery vapor. The white snowy nucleus which large hail stones frequently exhibit in the centre, indicates that the congelation began in highly rarefied air, such being precisely the appearance of a drop of water frozen under the exhausted receiver of an air pump.† And finally, the sudden and severe cold weather which often immediately follows a hail storm, only indicates that the cold blast which produced the hail, extends something of its influence even to the surface of the earth itself.

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* Edin. Encyc. vol. xv, Art. Phys. Geog. at an elevation of 1500 or 2000 feet.
† Leslie, Encyc. Ed. Meteorology.

What is the cause of the small momentum of hail stones? Although hail stones, when large, do great damage to tender crops, and occasionally kill small animals, yet it is, on the whole, surprising that they fall with no greater force than they do. A pebble of the same size falling from the mouth of a well upon the head of a man at bottom, would kill him: and the meteoric stones which fall from the sky, many of which do not exceed the size of some hail stones, bury themselves deep in the ground, and sometimes even penetrate through the entire body of a house, and bury themselves in the cellar.* The small momentum of hail stones is partly to be ascribed to their low specific gravity, which is a little less than that of water; but still they are heavy enough to fall with a hundred times the momentum which they actually exhibit, descending as they do through many thousand feet. Their velocity is, in fact, very small, whereas, we should expect to find it immensely great; the true reason of this, I apprehend, to be the following. We are to regard the largest hail stone as commencing its formation with a small nucleus, and as receiving continual accessions of matter in descending, until it reaches the ground. But the watery vapor, of which these accessions are composed, is matter at rest to be put in motion by the falling body, which is, therefore, taking on a new load at every stage of its progress, and consequently has its speed continually retarded. The velocity which it acquires in falling, each successive moment, is lost by communicating motion to so large a quantity of matter at rest, as that which composes its accretions.—*Amer. Jour. Science.*

INSTINCT.

There are various actions, and trains of actions, occasionally to be met with among mankind, but more frequently and more strikingly among other animals, which indicate the employment of definite means to obtain a definite end, without the intervention of that chain of thought which characterises *reason*, and which have hence been ascribed to a distinct principle, that has been distinguished by the name of *instinct.*

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* See an amusing account of the force of falling hail stones, by Fairfax, in the first volume of Phil. Transactions.

Such, in the new-born infant, and indeed in the young of all mammalian animals, is the act of hunting out for the mother's milky food, and of sucking with a perfection which can never be acquired in subsequent life. Such is the whole process of nestling or nidification among birds; the periodical change of salt for fresh water among the sturgeon, salmon, and other fishes; and, among insects, the formation of the exquisite decoy-lines of the spider, and the nice masonry of the bee, and of the termes *bellicosus*, or white ant.

The common fact admits of no dispute; the modes of accounting for it have been various, and, in the utmost degree, unsatisfactory.

In various cases of the instinctive faculty the most excursive theorist cannot picture to his imagination any thing like a chain of thought, or previous reasoning; any thing like a habit or imitation by which the means and the end are joined together. Let us take, as an example, the very common instance of a brood of young ducks brought up under a hen, and contrary to all the instincts and feelings of the foster mother, plunging suddenly into the water, while she herself trembles piteously on the brink of the pond, not daring to pursue them, and expecting every moment to see them drowned. By what kind of experience or observation, by what train of thought or reasoning has the scarcely fledged brood been able to discern that a web-foot fits them for swimming, and that a fissured foot would render them incapable?—a knowledge that mankind have only acquired, by long and repeated contemplation, and which has never been fully explained to this hour. Habit, imitation, and instruction, would all concur in teaching them to flee from the water, as a source of inevitable destruction: and yet, in opposition to all these influences and premonitions, we see them rush into it, and harmlessly: we see them obeying an irresistible impulse, which directs them to what is fitting, stamped in the interior of their little frames, and which is equally remote from the laws of mind and of mechanism.

In like manner, by what process of imitation, education, or reasoning, does the nut-weevil (curculio *nucum*) seek out, exclusively, and with the nicest knowledge of the plant, the green hazel in the month of August, while its nut-shell is yet soft and easily penetrable? What past experience, or course of argument, instructs her that this is the fruit best adapted, or perhaps only adapted, to the digestive powers of her future progeny? With a finished know-

ledge of her art, as soon as she is prepared to deposite her eggs, she singles out a nut, pierces it with her proboscis, and then turning round accurately drops an egg into the minute perforation; having accomplished which, she passes on, pierces another nut, drops another egg, and so continues till she has exhausted her entire stock. The nut, not essentially injured, continues to grow. The egg is soon hatched; the young larve or maggot finds its food already ripened and in waiting for it; and about the time of its full growth, falls with the mature nut to the ground, and at length creeps out by gnawing a circular hole in the side. It then burrows under the surface of the ground, where it continues dormant for eight months, at the termination of which time it casts its skin, commences a chrysalis of the general shape and appearance of the beetle kind, and in the beginning of August throws off the chrysalid investment, creeps to the surface of the ground, finds itself accommodated with wings, becomes an inhabitant of the air, and instantly pursues the very same train of actions to provide for a new progeny which had been pursued by the parent insect of the year before.

In all such cases, it is clear that there is a principle implanted in the living form equally distinct from all mechanical, chemical, and rational powers, which directs the agent, by an unerring impulse, or, in other words, impels it by a prescribed and unerring law, to accomplish a definite end by a definite mean.

Nothing, therefore, is clearer than that the principle of instinct has hitherto never been explicitly pointed out, nor even the term, itself, precisely defined; it has been derived from mechanical powers, from mental powers, from both together, and from an imaginary intermediate essence, supposed equally to pervade all embodied matter, and to give it form and structure. It has been made sometimes to include the sensations, sometimes the passions, sometimes the reason, and sometimes the ideas; it has, sometimes, been restricted to animals, and sometimes extended to vegetable life.

Under these circumstances, I shall beg your candid attention to a new view of the subject, and a view that may tend to give us a more definite idea of the nature of the action, and consequently, of the extent and real meaning of the term.

In an early lecture of the preceding series, I have endeavored to point out the common or essential, and many of the peculiar pro-

perties of inorganic matter; and in a subsequent study I attempted to lay down the more prominent characters by which inorganic is distinguished from organic matter, as a stone, for example, from a plant or an animal. I observed that, on investigating the history of the stone, it would be found to have been produced fortuitously; to have grown, by external accretion, and only to be destructible by chemical or mechanical means: while, on investigating the history of the plant or the animal, it would be found to have been produced by generation; to have grown by nutrition, or internal, instead of external accretion; and to be destructible by death; to be actuated by an internal power, and possessed of parts mutually dependent, and contributing to each other's functions. I observed, further, that in what this internal power consists, we know not: that in plants and animals it appears to be somewhat differently modified, but that, wherever we meet with it, we term it the PRINCIPLE OF LIFE, and characterize the individual substance it actuates by the name of an organized being, from its possession of organized parts, in contradistinction to all those substances which are destitute, as well of life as of internal organs, and which are hence denominated unorganized.

In every organized system, then, whether animal or vegetable, and in every part of such system, whether solid or fluid, we trace an evident proof of that controlling and identifying power which physiologists have denominated, and with much propriety, the PRINCIPLE OF LIFE. Of its cause and nature we know no more than we do of the cause and nature of gravitation or magnetism. It is neither essential mind, nor essential matter; it is neither passion nor sensation; but though unquestionably distinct from all these, is capable of combining with any of them: it is possessed of its own book of laws, to which, under the same circumstances, it adheres without the smallest deviation: and its sole and uniform aim, whether acting generally or locally, is that of health, preservation, or reproduction. The agency by which it operates is that which we denominate, or should denominate, INSTINCT; and the actions by which its sole and uniform aim is accomplished, are what we mean, or should mean, by INSTINCTIVE ACTIONS; or, to speak somewhat more precisely, instinct is the operation of the living principle, whenever manifestly directing its operations to the health, preservation, or reproduction of a living frame, or any part of such frame.

The law of instinct, then, is the law of the living principle; instinctive actions are the actions of the living principle; and either is that power which characteristically distinguishes organized from unorganized matter, and pervades and regulates the former as gravitation pervades and regulates the latter, uniformly operating by definite means, in definite circumstances, to the general welfare of the individual system, or of its separate organs; advancing them to perfection, preserving them in it, or laying a foundation for their reproduction, as the nature of the case may require. It applies, equally, to plants and to animals, and to every part of the plant, as well as to every part of the animal, so long as such part continued alive. It is this, which maintains, from age to age, with so much nicety and precision, the distinctive characters of different kinds and species; which, as is noticed in a preceding study, carries off the waste of worn out matter, supplies it with new, and in a thousand instances suggests the mode of cure, or even effects the cure itself, in cases of injury or disease. It is "the divinity that stirs within us" of Stahl; the vix medicatrix naturæ of Hoffman and Cullen, and the physicians of our own day. It is hence the strawberry travels, from spot to spot, and the cod or the cuckoo, with a wider range, from shore to shore, or from clime to clime.—*Good's Book of Nature.*

(*To be Continued.*)

NATURAL HISTORY.

THE ONE HORNED RHINOCEROS OF INDIA.

Rhinoceros Indicus. Cuv.

An animal of this species has recently arrived in this city, the first time it has been seen in a living state, in America. He has always been of great rarity, not more than five or six having, at different periods, been brought to Europe since the year 1593, when the first living specimen was presented to the King of Portugal. One is now living in the menagerie at the Jardin des Plantes, in Paris. It would seem that he was better known to the ancients, since we have accounts of him from Pliny, Dion, Cassius, and others, from whom we learn that he was frequently exhibited in their circus and triumphal shows. The one horned kind is the only one which has been brought alive, in mo-

dern times, to Europe, though the two horned species was exhibited at Rome in the time of Domitian.

The Rhinoceros, now in the city, is quite a young animal, being about 1½ years old, and perhaps half grown; his height is 4½ feet, and over 7 feet in length, and weight near 2000 lbs. He was imported from Calcutta, whither he had been brought when very young, from the interior of Asia, near the Himalaiah mountains. His form is bulky and clumsy, like that of the Elephant, though his height is much less in proportion to his length. His body is covered, or rather armed, with a hide of tough and leathery consistence, roughly tuberculated with knots, and curiously separated into large divisions, by folds or plaits, behind and across the shoulders, and again before the thighs, and across the buttocks, exactly as represented in the following figure, which was taken from the animal.

This hide is so thick as to be impenetrable even to a powerful force; and it is only in the furrows made by the folds, or in the abdomen, or near the eyes, that he is assailable. It would seem that the folds are intended to act as hinges or joints to enable the animal to turn himself, lie down, rise up, or the like, since it would be very difficult for him to perform any other than a strait forward movement, if the hide were one uniform crust, without division. Another remarkable peculiarity in the structure of the Rhinoceros, is the horn on his nose, to the bone of which it is firmly attached, and is no doubt a formidable weapon of attack or defence, as well as a serviceable instrument in searching for food. In the adult animal, the horn is said to extend to the length of nearly three feet; in the present one, it is just beginning to grow, and protrudes in a knob of 3 inches above the nose. The structure of the upper lip

is also remarkable; which, although it does not extend much beyond the lower one, is capable of being elongated to answer the purpose of a proboscis, the end of it being pointed so that he can take the smallest particle of food. While masticating, he uses the end of this lip, in a singular manner, to keep the cud he is chewing within the action of his grinders—thus serving the office of his tongue, which is short. No part of his body appears to have any hairs, excepting the tufts at the tip of his ears and tail. There are only two incisors in the lower jaw, none having yet appeared in the upper. Little is known of the habits of this strange animal; his shy and solitary manner of life, in his native haunts, preventing any opportunities of discovering his peculiar characteristics. He is usually found in the forests of Eastern India, in the regions watered by the Ganges, seeking his subsistence in the densest and most impenetrable thickets, and marshes of those districts, his coat of mail enabling him to overcome the obstacles of such situations which no other animal could approach. Pliny states, that the natural enemy of the Rhinoceros is the Elephant; and that, in their combats, he uses his powerful horn in stabbing his antagonist in the belly where he is most assailable.

The animal now with us, appears to be of a stupid nature, and exhibits no traits of intelligence or instinct beyond those of the Hog, to which he seems to be allied in manners as well as form. He appears to distinguish no one around him, and to be insensible to every thing but the calls of appetite; eats constantly, whenever food is offered to him, and almost of any kinds, roots, grain, fruit, or herbage, and is very fond of sugar. He is equally gluttonous in drinking. It is singular, however, that his natural placidity of temper should be interrupted by a fit of passion, which he is subject to every day, with the greatest regularity, and sometimes twice a day. The fury attacks him, with more or less of violence, during which, he is entirely ungovernable, runs about butting with his horn against any thing within his reach, and is only appeased by offering him some of his favorite sweet food.

According to the natural system of arrangement, the Rhinoceros is classed among the *Pachydermatous*, or thick skinned animals, along with the Hog, Tapir, Elephant, &c. There have been five distinct species enumerated, three of them, viz. *R. Sumatrensis*, *R. Africanus*, and *R. Burchellii* having two horns on the nose, and two of them the present species, *R. Indicus*, and *R. Sundaicus* with a single horn.

It is remarkable, as proving the changes which our globe has undergone, that this race of animals, which is now confined to tropical regions, has existed in former days in the more temperate and cold districts of Europe, in company with the Elephant and other tropical animals of the present day. In the year 1771, the entire carcase of a species, named by Cuvier, *R. tichorinus*, was dug from the ice in Siberia, with part of the skin still adhering to it. This animal was larger than the African species, was furnished with two horns, and was remarkable for having thick strong hair on its hide, as if it had been peculiar to a cold climate. The fossil bones of this species have been found in other parts of Europe, chiefly in France. The bones of another species, *R. leptorhinus*, Cuv. smaller than the preceding, and likewise having two horns, have been found in a fossil state in Italy; and a third species, the smallest of the race, named by Cuvier, *R. minutus*, about the size of a Hog, was disinterred from the depth of 60 feet below the surface of the earth, at St. Laurens, in France.

RUFFED LEMUR. *Lemur macaco.* L.

This animal, which is also a great rarity, has recently been added to our zoological collection. A pair of them, male and female, are now exhibiting along with the Rhinoceros. They are very beautiful animals, rather larger than the common cat, and their form seems to be intermediate between the Fox and Monkey, with the body and pointed snout of the former, and the four hands of the latter. Their fur is soft and long, and tail bushy, and of great length. The face, shoulders, hinder part of back, tail and feet, glossy black; all the rest beautiful white. Their movements exhibit all the agility and vivacity of the monkey tribe, to which, in the natural scale, they are proximately allied, though they do not appear to possess any of their intelligence, or mischievous propensities. They are exceedingly gentle and docile, and appear to be quite affectionately disposed to each other. It is said, however, that these traits are only observed in the animal while in confinement. In their wild state, they are said to be very fierce and cruel; and at times their natural disposition breaks out, when domesticated, so that they kill and devour each other.

These animals were brought from Madagascar, their native country.

AGRICULTURE.

SALE OF VALUABLE CATTLE.

It is very difficult to persuade our farmers that there is any *material* difference in the breed of cattle, or that their stock can be much improved; while they all agree that the value of a horse depends much upon his *blood*, and the goodness of fruit upon the tree that produces it, there is scarcely one in a thousand that ever takes the least pains to improve the breed of his cattle, by selecting such, and such only, to raise stock from, as are possessed of those qualities which give value to the animal: the truth is, they seem not to know the real difference between a *first rate*, and a *common* cow. There are, however, a few, who are not obnoxious to this general charge; among the number is Col. Powel, of Powelton, near Philadelphia. Col. Powel has, for several years past, turned his attention to this subject, and has probably done more towards improving the breed of cattle in our country, than any other individual; for this he not only deserves the thanks of the community, but something more substantial, which, judging from the price he has lately obtained for his stock, he has already realized. The Col. being about to visit England, with the intention of selecting and importing other cattle from the best breeds in that country, lately offered his own stock at public sale, which was attended by a great number of persons, among whom were many distinguished men from different parts of the United States, as well as several foreigners.

The following are the prices obtained, namely;

Volante, a cow, 5 years old,	$305
Annabella, " 6 "	310
Stately, " 9 "	240
Zenobia " 7 "	410
Sarah, " 6 "	410
Marcia, " 7 months,	240
Nine other cows, average each,	265
Bolivar, a bull, 5 years old,	405
Tecumseh, " 2 "	510
Diego, " 1 "	300
Orlando, " 11	300
Memnon, " 3 "	405

Romp, calf six days, ... 120
Gipsey, a heifer, 9 months, ... 200
Yorkshire belle, a diseased cow, and sold as such, . 151

The average price of all, except the six months calf, and the diseased cow, is $320 each.

The removal of these fine and valuable cattle into different, and distant parts of the country, cannot, we think, fail to have a salutary effect, inasmuch as it will enable farmers in the vicinity of them to avail themselves of the opportunity of improving their own stock, which no one will neglect who studies his own interest.

DOMESTIC AND RURAL ECONOMY.

MANAGEMENT OF BEES.

Nothing can be more cruel than the practice, which we believe to be almost universal among our farmers, of destroying that most useful and interesting insect, the Honey Bee, for the purpose of obtaining those treasures which its industry and skill have accumulated, and its sagacity provided for food during that season when it must cease its operations. Setting aside the barbarity of the practice, nothing can be more *unnecessary* and *unprofitable* to the cultivator of the Bee, who may just as well avail himself of its industry and preserve its life; in truth, the destruction of this little animal, for the sake of its honey, forcibly reminds us of the fable of the goose and the golden egg, with which we presume every one of our readers is familiar; if not, however, we recommend them to read it. The industry of the Bee is proverbial, and if properly managed, a hive is able, not only to provide a sufficient supply of provisions for themselves during the winter, but will furnish a considerable surplus: in France, and the European countries generally, this is well understood: instead, therefore, of destroying their Bees in autumn, they take from them, from time to time during the summer and flowering season, as much honey as they deem it prudent, which the Bees immediately go to work to supply again—or they sometimes adopt another method, that of inducing the Bees to leave the hive which they have already filled, and enter an empty one; this is done in the following manner:

In the dusk of the evening, when the inhabitants of the hive are all collected within it, take it from the place upon which it stands, and set it, bottom side up, upon the ground; then take a clean hive, prepared for the purpose, and place it upon the old one, the bottom of course being open. Having done this, rap the old hive gently with a stick, some fifteen or twenty minutes, during which the Bees will leave it and enter the new one. This being done, lift the new hive carefully from the old one, and place it upon the bench from whence the other was removed. You will now have the honey separate from the Bees, and perfectly clean and nice. The Bees, finding their treasure gone, will by no means give themselves up to despondency, but fall to, like industrious fellows, as they are, and if they have time, (and to allow them that, this should not be done later than about the middle of August) will provide an ample store of provisions for the winter.

There is another way of abstracting honey from a hive which we have seen, and which we recommend to those who wish to enjoy the luxury of fresh honey. The hive is made of four boards, each about three feet long, and about one foot wide, nailed together: both ends are closed by other pieces of boards, a foot square; that at the end, where the entrance is intended, (and it is to be observed that the hive is to be laid flat upon a bench) is nailed on, the other is hung at the top by hinges, and is fastened down by a button or hasp. When honey is wanted, it can be had at *any time;* it is procured in the following manner: raise the back end or door a very little, and hold under it for a few moments, a burning rag—the Bees will immediately leave that end of the hive and flee to the other: this being done, you may then raise the door, and take out, unmolested, as many pieces of beautiful honey-comb, *of the size of the box*, as you have occasion for. Upon closing the door again, the Bees will immediately go to work to fill up that part of the hive which has thus been made vacant, and should you have but one hive, and have occasion for more fresh honey again a few days after, you will find it already prepared for you by this laborious little insect.

GREEN PEAS.

This agreeable and nourishing vegetable can be preserved any length of time, so as to be scarcely distinguishable from the fresh article which is just taken from the pod. They are to be gathered when just ripe and still green, removed from the shell, and spread in thin layers, on boards, and dried in an oven gently heated. They quickly part with their moisture, retaining their green color, and all their savory and nutritious properties. In this state they may be kept in a dry place for years, without losing any of their good qualities. When they are to be used, they should be soaked a night previously, in water. The farmer who will practice this method, will be fully repaid for his trouble by the price which an article prepared in this way will command in the markets, during the winter season. The manner of drying them, by the heat of an oven, completely destroys the insect, such as the weavel, or other eggs, which are deposited in the seed.

SCIENTIFIC SOCIETIES, SCHOOLS, &C.

We are a little surprised that no notice has as yet been taken in this country of a school, which affords perhaps one of the finest nurseries in the world for practical Mechanics and Manufacturers. We refer to the "*Central school of the Arts and Manufactures*," recently established at Paris, under the auspices of the ex-minister, Vatismenil, director of the public literary institutions, and under the *surveillance* of a committee, among whom are Chaptal, Brogniart, Lafitte and others, well known for their devotion to Science and the Arts. The prospectus of the school states as reasons for its establishment, "the difficulties experienced in the French manufactories, within the last few years, and the superiority of England in this branch of industry, attained by the division of labor. France, to compete with her, requires skilful workmen, competent overseers, directors still better instructed, and civil engineers over all, who, devoting themselves exclusively to a particular branch of mechanical industry, are able to surmount all practical difficulties. Young men, having completed their education at

the respective colleges, can pursue the studies of medicine, law, theology, and even the fine arts, at schools specially instituted for those pursuits; but those who wish to give their attention to mechanics, have no opportunity of gaining instruction.

"The school of arts and manufactures has been established to meet this want; its object is a system of *practical instruction in Geometry, Physics, Mechanics, Chemistry, Natural History* and *Statistics, as applied to Mechanical Industry.* It is instituted specially to qualify young gentlemen, not only to become *overseers* of *factories, glass-houses, dye-houses, iron-foundries, mines,* &c. but to make them *chemists, builders, civil engineers,* or in short, to give every one who wishes to devote himself to a branch of practical industry, be it what it may, such instruction as will be highly profitable."

The courses of instruction, above mentioned, are parts of one system: *Geometry* teaches the relations of masses of matter to each other; *Physics,* the manner of putting them in motion; *Mechanics,* the means by which this motion is increased or diminished, or its direction changed. *Chemistry* divides these masses into molecules, and combining them again in new forms, enables us to foresee their properties. If the material is not given, the aid of the *miner,* or of *Natural History* is invoked to furnish it. All these operations require particular buildings; hence the advantage of knowing how to construct them; and finally, the course upon *Statistics,* makes one acquainted with the resources and the social relations of the country in which he is placed.

All the branches of industry, without exception, belong to one or more of the exact sciences; but the arts of industry are not merely the applications of their theories; mechanics, physics, &c. are, it is true, connected with them, but only in their method of investigation, and their general principles. Theoretical and practical researches differ extremely in their purposes and end; the first have principally, for their object, the establishment of general laws, while certain elements, of great importance in a practical point of view, are omitted. Thus, in Chemical operations, no note is taken of the time employed, or fuel consumed: items which influence, in a great degree, the expense of the process. In order, then, to the utility of the school, the instructors should be men well versed in theories, and who have been in actual service in different factories, since it is when *surrounded by operatives, and*

then, only, that we can test the actual value of theories, and the limits by which their useful application is bounded."

The course of instruction is *general* and *special.* The *general* instruction occupies two years, and comprises attendance upon lectures, daily examinations, drawing, designing, manipulations in chemistry, physics, and mechanics, the construction of apparatus for chemical or mechanical purposes, resolution of problems, and drawings of plans, of partial *concours*,* general examinations and general concours. The courses of lectures are ten, viz. :—

Descriptive Geometry, applications of Physics, application of Mechanics, Chemistry, the Chemical Arts, Analytical Chemistry, Mining, Application of Natural History to Industry, Art of Building, Statistics and Drawing. Daily examinations are made by the Professors, notes are taken of the progess of each pupil, and these regulate the distribution of the diplomas, which are given to the meritorious at the close of the second year.

The *drawings* will exceed 400 in number, executed by rule, compass and scale, representing machines and apparatus of every kind, and on every subject connected with the courses of lectures; they will be examined each day by the professors. The experiments in *chemistry* are numerous, being designed to form practical chemists: each division will be employed once or twice a week in laboratories large enough for 150 pupils, where all the experiments in mechanics and physics will be performed. The pupils then, being allowed materials, will construct some large apparatus, and put it into action, the plans being given them by the professors.

In order to complete the system of instruction, problems are given out for solution during the first year; while in the second, plans more and more complicated will be offered in *concours.* These will render the pupils familiar with the building of machines, and also with the most suitable mode of arrangement in each department of industry. In order to give these pursuits a character still more practical, the pupils will be required to fit together the different parts of machines, and sometimes to calculate the dimen-

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* These Concours are a species of examination: usually a prize is offered; the candidates assemble; certain questions for solution are put into an urn; each candidate draws one, and is obliged, after 20 minutes, to speak upon it a certain length of time, and defend his opinion; the most meritorious wins.

sions of one or more parts, which will then be constructed, under their inspection, by workmen attached to the establishment; when the machine is in operation it will be inspected by the professors.

At the close of the first year, there will be a general examination in all the branches of instruction, and the pupils, if qualified, will pass from the second division to the first. After being two years employed in this manner, the pupils will pursue their studies as they may wish: they will be divided into classes, placed under the particular charge of that professor whose branch of instruction they propose to pursue: their theoretical education will be completed, and then, by entering any establishment they may choose, they will bring their knowledge into practice. The chemist will be instructed in the more difficult parts of general chemistry; in the school will be found all the materials and chemical products for dyeing, bleaching, manufacture of paper, sugar, starch, porcelain, alcohol, &c. The mechanic will be employed in the details of constructing moving powers, will study machines in motion, &c. The architects and builders, will be occupied in constructing edifices, while the civil engineer will pursue the study of the pure mathematics, the integral and differential calculus, &c.

It is impossible to comprise, within a few pages, all the details of a school so extensive. It will be sufficient to say, that the whole is conducted in the most liberal manner. The tuition is $125 per annum, but as it is the wish of the directors that those who distinguish themselves shall be instructed almost gratuitously, prizes are from time to time offered, and the meritorious are appointed monitors, receive a salary of $125 per annum, and pursue their studies as usual. The requisites for admission are few, and as regards a knowledge of the French language, foreigners are favored; the hours for study are well arranged, and the library extensive. Attached to the school are cutlers, carvers, glass-blowers, &c. that the pupils may make their own instruments, and chemical apparatus.

In conclusion, it may be well to remark that the directors have the power of fulfilling their promises, as all the principal capitalists in France are concerned with them. The school is very flourishing; already applications have been received from different parts of Europe for young men to be employed as directors of factories, mines, &c. In November (when the school commenced) there were 110 pupils, among whom several Americans are not the least distin-

guished for their industry, and close application;* they will return to us with the newest lights of science, and prove themselves useful acquisitions to our country.

FROMONT HORTICULTURAL SCHOOL.

In connection with the account we have given of a school of the arts and manufactures, we notice an institution recently established in France, for the education of Gardeners. The Chevalier Solange Boudin, one of the most eminent Horticulturists of the age, has devoted his extensive and rich garden of Fromont at Ris, near Paris, to the purpose of instructing young men destined to the pursuits of Horticulture. In this establishment able professors are engaged to initiate the students in every branch of knowledge relating to the theory and practice of gardening. Every season a complete course is given of Botany as applied to horticulture; a course of culture, in which the principles, chemical and practical of manures and the formation of soils proper to rear the different sorts of plants, whether fruit or forest trees, ornamental trees and shrubs for public grounds, culinary vegetables and others of various uses in medicine, the arts, or for merely ornamental purposes; a course also of lectures on the theory and composition of landscape gardening. In addition to these advantages the students have the use of a library of the best books appertaining to the subjects of their study, and, to a cabinet of models of the various utensils used in gardening. A Herbarium is also provided for their use, of exotic and native plants, to which the pupils are obliged to contribute by preparing the remarkable plants cultivated in the garden. A monthly journal is published, by the proprietor and his associates, of the most interesting circumstances, which have been observed in the establishment, affording instruction both to the student and the public. An institution of this sort, conducted by men of undoubted talents and experience, must have a most important influence in improving the state of horticulture in every part of the country. Every year a body of well instructed and well practised gardeners are sent to various parts of the empire to increase the physical resources, and improve the moral condition of the inhabitants.

* Among the most distinguished of the school, is Mr. Haven, of Portsmouth, N H.

ALBANY INSTITUTE IN THE CITY OF ALBANY.

By the union of the Society for the Promotion of Useful Arts, and the Albany Lyceum of Natural History, an association, bearing the title of Albany Institute, has been formed, and was incorporated in February, 1829. The object of the institution is to collect and diffuse information on all subjects of scientific interest; and it would seem that the gentlemen who compose the Society, have labored with much zeal and talent in the accomplishment of their design. Under their management a library has grown up embracing several rare and valuable works, and a cabinet of specimens, of various subjects, tending to illustrate the civil and natural history of our state, together with other rarities in the useful arts, antiquities, &c. Part of the first volume, consisting of 4 Nos., has appeared, and we recognise among the contributing members, the respectable names of Drs. T. R. Beck and L. C. Beck, Messrs. J. Henry, J. G. Tracy, and I. Geddes; and among the correspondents, professors Jacob Green, and Amos Eaton, and J. O. Morse. With such materials, and the elevated standard which is assumed for the model of their publications, the Institute will, we hope, be supported by popular countenance, and receive all the aid it deserves from the liberality of the citizens of the ancient and wealthy city of Albany.

NEW-YORK HORTICULTURAL SOCIETY.

This Society is also to be numbered among the living and efficient associations which have been combined for promoting the cause of useful knowledge in our state. The affairs of this Society are in a high degree encouraging, and in a progressive state of increase in funds, and the number of its associates. Weekly meetings are held, in which the rarities of the garden and orchard are richly and abundantly exhibited. This society, in common with most other voluntary associations for mutual improvement in the useful arts and sciences, has to derive its resources entirely from the contributions of its members; and the principal part of the funds, obtained in this manner, is applied yearly to the premiums which are offered to encourage Horticultural merit.

Notwithstanding the limited extent of their means, much good is effected by the members of this Society, in introducing and diffusing improvements in the principles and practice of gardening, which are discovered, from time to time, in our own country, or are received from others. Their proceedings exhibit satisfactory evidence of the capabilities of our climate, and the productions which are weekly brought forward afford no less gratifying proofs of the skill with which these natural advantages are rendered available.

NEW-YORK LYCEUM OF NATURAL HISTORY.

This Institution continues in full vigor and activity, with the intermission, however, which is usual in the warm season of the year. Ever since the period of their incorporation, in 1819, the society has continued to prosecute the object of its formation; the attention of the members is exclusively directed to the cultivation of Natural History, and by the excellent regulations of the Lyceum, this object is rigidly kept in view, and no other. This unity of purpose has principally contributed to the present very flourishing condition of the Society. By the individual labors and contributions of its members, which, in truth, are almost the sole means which they can rely upon, they have amassed an amount of property altogether unrivalled for its extent and value. Their library consists of books exclusively on subjects of natural history, and contains many very rare works. Their cabinet is stored with a rich and extensive suite of minerals and geological specimens both native and foreign. Their Botanical collection is highly valuable, the Herbarium containing nearly 2-3ds of the Flora of the Union, and nearly 10,000 specimens of Foreign plants. In Fossil zoology their collection is particularly important, having many unique specimens which are only to be met with in the Lyceum, or no where else so complete; such as a nearly entire skeleton of the mammoth, the megatherium of Georgia, and many other extinct animals.

These invaluable treasures are by no means confined to the use of the members. The student of nature is liberally invited to make use of the property of the Lyceum without charge, and free admission to the cabinets is at all times to be had by the public or strangers.

MISCELLANY.

DICTIONARY OF CHEMISTRY.

We have carefully examined a "*Dictionary of Chemistry, with its application to the Arts, Manufactures, and Medicine*," translated from the French, by Mrs. Lincoln, of the Troy Seminary, and recently published by the Messrs Carvill. Mrs. Lincoln deserves the thanks of all engaged in practical pursuits, for this new help: a work of the kind has long been wanted, and we are glad to find one executed with so much ability.

The translation is faithfully correct; the additions interesting and important; and the whole presents us with an exact view of the science at the present day. In the course of our pursuits, having frequently referred to the original work and the translation, we can safely say, that in none have we found such a mass of information condensed within so small a compass. The book, to be appreciated, needs only to be known.

STAINED GLASS.

The art of staining glass, as practised by our ancestors on the windows of their Cathedrals and Churches, has been lost for about two hundred years; it is now supposed to be recovered: at least, a method has lately been discovered, (whether the same or not, we are unable to say,) of staining glass in a manner that produces the same effect. Specimens of the art are now being exhibited in this city; they consist of the likenesses of the several Presidents of the United States and La Fayette; a gothic window, and several other articles, all very beautiful, and worthy the attention of the amateur of the fine arts.

THRESHING MACHINE.

On our cover will be found a cut of a Threshing Machine, invented by Mr. Owen G. Warren, of this city, which is highly spoken of, and which, from the slight examination we have been able to give it, we think a very important acquisition to the farmer. For further particulars, we refer to Mr. Warren's advertisement.